

2009 Environmental Working Group Operations Standing Committee

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Presented by

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On Behalf of

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# UAL Tailored Arrivals

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CNS Task Force LAS Meeting

April 8th, 2009

Aaron Bricker

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# Project

## Eliminate Fuel Waste Due to Inefficient Arrivals

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- Goals:
  - Eliminate waste due to inefficiencies and variability.
  - Control process in order to maintain improvements.
- Utilize Lean Six Sigma Continuous Improvement methodology to determine significant sources of variation and their impacts.
- Operational Definitions:
  - Tailored Arrival: Considers airspace and traffic constraints.
    - The SFO arrivals were built with Airline, OEM and FAA collaboration.
  - Partial Tailored Arrival: Vectored off of the instructed path during the descent.
  - Oceanic Arrival: Via an Oceanic airspace.

# Project - Continued

## Eliminate Fuel Waste Due to Inefficient Arrivals

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- Oceanic Tailored Arrivals (OTAs) have the greatest impact on arrival fuel consumption for UAL B777 and B747 arriving into SFO.
  - Other factors with lesser impact:
    - Aircraft Configuration Changes to Reduce Drag
    - Passenger and Cargo Loading Changes (Zero Fuel Weight Adjustments)
    - Flight plan changes (during preflight planning and en-route)
    - Efficient Arrival Requests by Flight Crews
- UAL Metrics for Tracking Performance
  - % of Tailored Arrival Instruction Requests by Flight Crew
    - Instruction request rates tracked due to fuel data constraints.
    - No request, no savings.
  - % of Full Tailored Arrivals Completed per Instruction Request
    - Analysis does not include Trans-Pacific flights that arrive into SFO from the North Bay Area.



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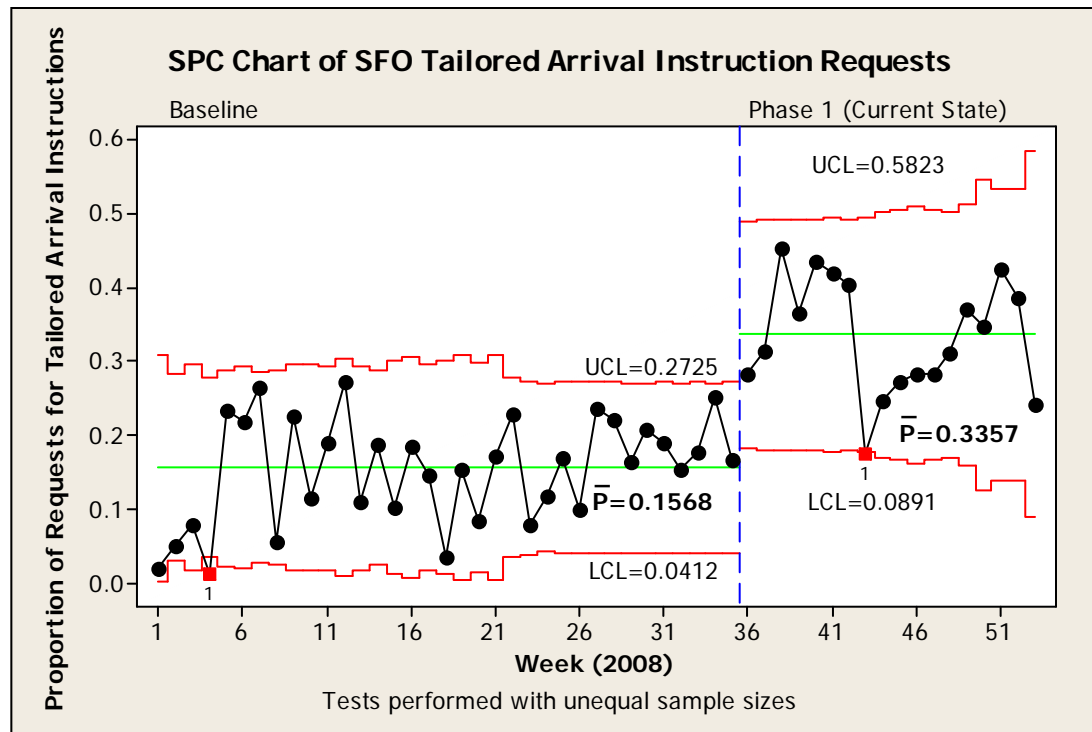
# Data

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- UAL Simulators – Denver Training Center
  - Experimental program developed to determine mean fuel consumption during landing.
    - 72 simulator flights, 36 each for UAL B747-400 and B777-200 aircraft types.
    - Flights modeled landings for Full Tailored, Partial Tailored and Standard Arrivals.
  - Statistical analysis of experimental data was used to validate fuel consumption and environmental benefits.
- UAL Observation Flights
  - Five direct observation flights were completed.
    - Observation flights were completed to validate process and fuel consumption.
      - Observations showed arrival fuel consumption rates 5 to 20% lower than the experimental values.
  - Fifteen crew observation flights were completed.

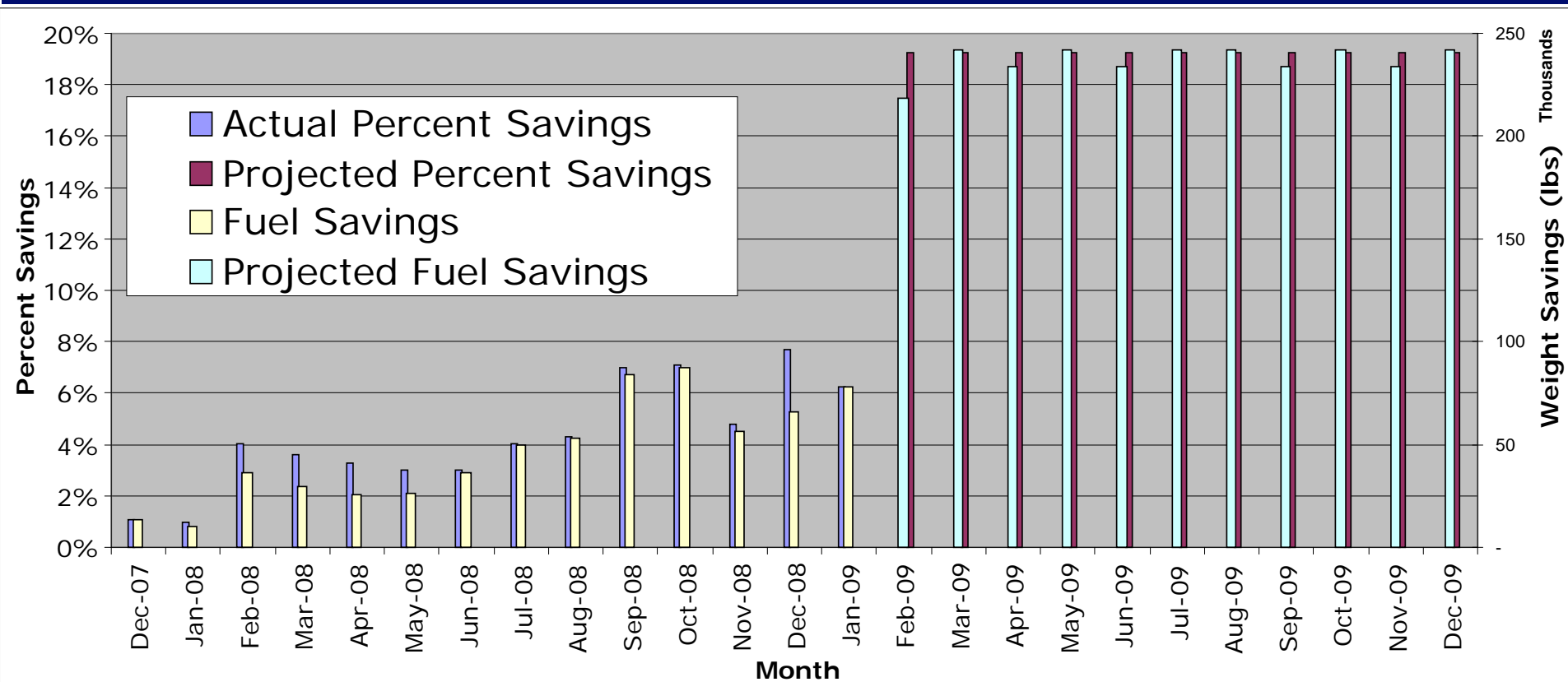
# Controls – Maintain/Improve Request Rate

- Charts are used to track number of requests for Tailored Arrival instructions and the number of Full Tailored Arrivals completed.
- Charts are used to determine success and maintain control.
- Statistical Process Control (SPC) charts for each metric.
  - SPC used to compare Baseline performance to Phase 1 performance. Phase 1 started Week 35 of 2008, date crew communication was incorporated.
  - % Request rate showed improvement, 16% to 34%.
  - % Full TA's Completed showed improvement, 28% to 35%.



# Results

## Fuel Percent and Weight Savings



- Projected Potential Average Savings – 19.26%
  - Assumes a distribution of full TAs, partial TAs and standard arrivals.
  - Assumes all applicable flights will request tailored arrival instructions.
  - Assumes all flights can request tailored arrival instructions (no North Bay arrivals).
- Actual Average Savings – 3.88%
  - Includes all applicable flights for all of 2008. Savings does not include actual flights arriving from North Bay.
  - Dec. '07 and Jan. '09 include all SFO arrivals. Assumes all flights could have requested tailored arrival instructions (no North Bay arrivals).
  - Not all arrivals requested tailored arrival instructions (not standard procedure).
- Results Calculated from 11 Normal Daily Oceanic Arrivals into SFO
  - Seven B777 Arrivals and Four B747 Arrivals unless otherwise noted (no North Bay arrivals).

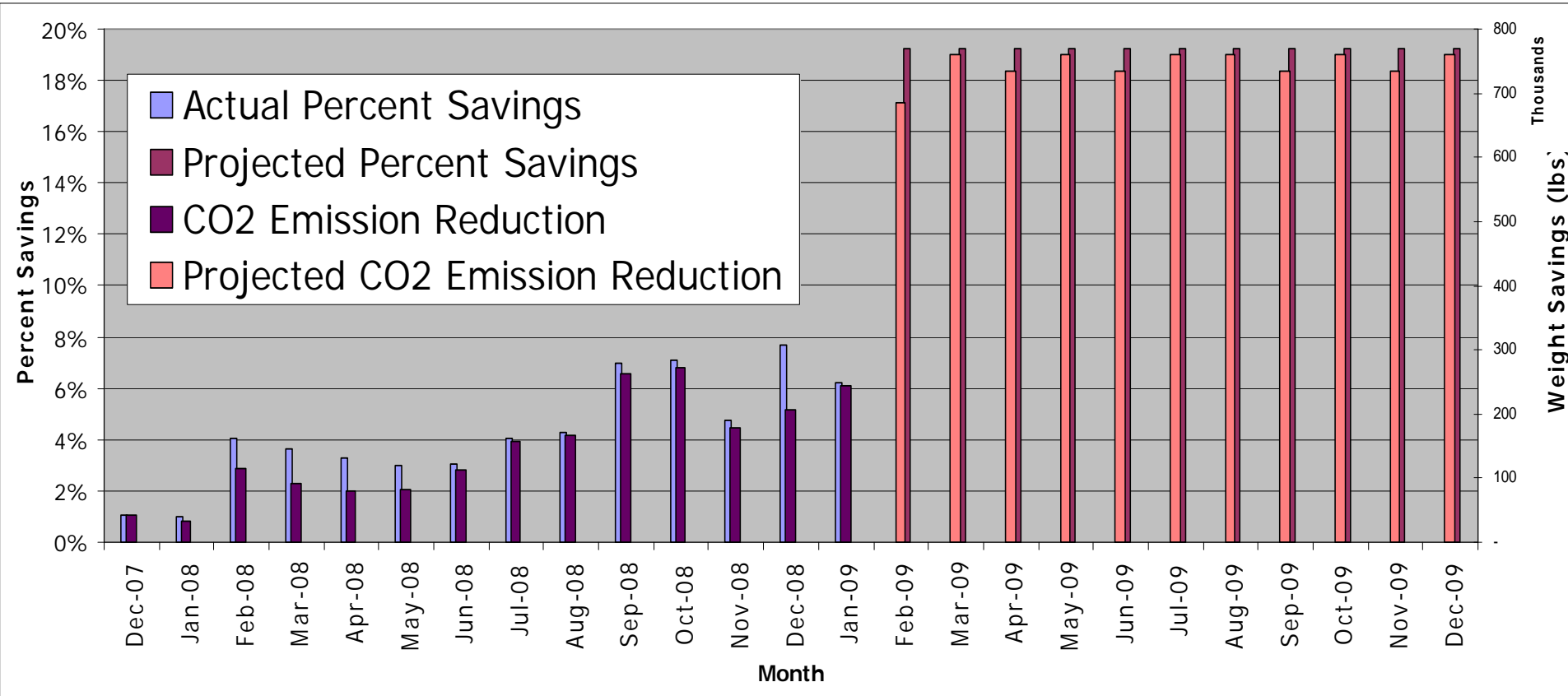


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# Results - Continued

## CO2 Emissions Percent and Weight Savings



- Projected Potential Average Savings – 19.26%
  - Assumes a distribution of full TAs, partial TAs and standard arrivals.
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- Actual Average Savings – 3.88%
  - Includes all applicable flights for all of 2008. Savings does not include actual flights arriving from North Bay.
  - Dec. '07 and Jan. '09 include all SFO arrivals. Assumes all flights could have requested tailored arrival instructions (no North Bay arrivals).
  - Not all arrivals requested tailored arrival instructions (not standard procedure).
- Results Calculated from 11 Normal Daily Oceanic Arrivals into SFO
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# Moving Forward

- Support LAX and other City Expansion
  - Observation Flights
  - Simulator Experimentation to determine value
- Further Team coordination and support.

